Managed Fire as a Fuel Treatment

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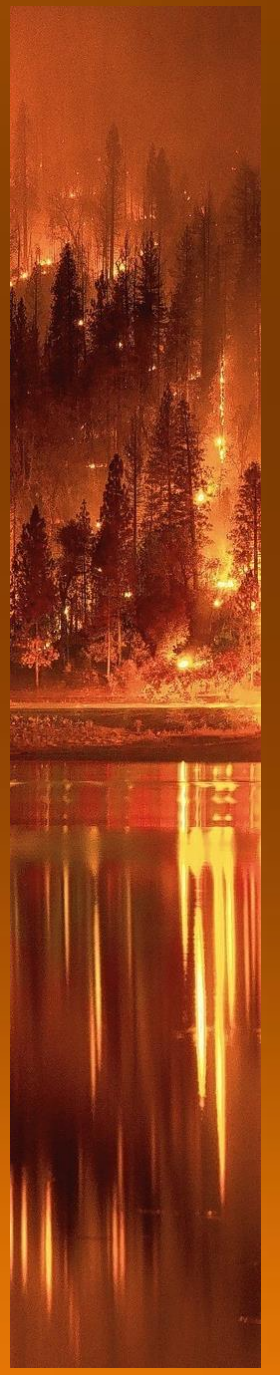
Why contemplate using managed fire as a fuel treatment?

"Current rates of fuels treatment on western public lands are far below what is needed to effectively influence landscape-level fire behavior or approximate historic levels of annual area burned." –North et al 2015

North, Malcolm, April Brough, Jonathan Long, Brandon Collins, Phil Bowden, Don Yasuda, Jay Miller, and Neil Sugihara. 2015. Constrains on mechanized treatment significantly limit mechanical fuels reduction extent in the Sierra Nevada. Journal of Forestry.

Why contemplate using managed fire as a fuel treatment?

- Mechanical treatment
  - Is expensive and time consuming
  - Is prohibited in some areas (e.g. Wilderness)
  - Is impractical in many other areas (e.g. areas that are too steep or too remote)
- Prescribed fire
  - Is also expensive and time consuming but less so
  - Is permitted and practical in many more areas
  - It's difficult to get a window to burn (based on weather and smoke restrictions)
- Managed fire
  - Opportunities exist probably every fire season
  - Less constrained by smoke and other regulations (true?)
  - Possible to opportunistically "treat" many more acres than using mechanical or Rx fire



What constitutes a fuel treatment?

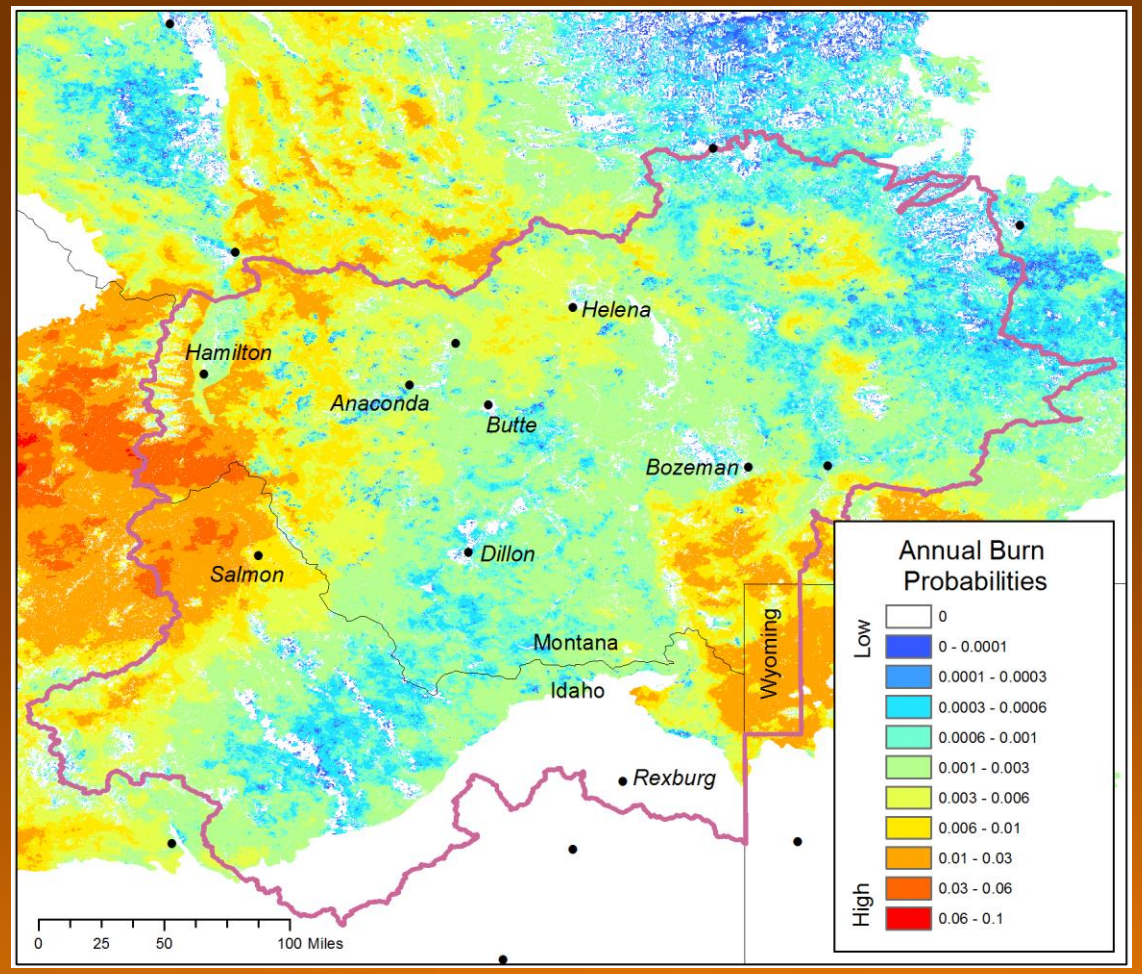
- Restores forest structure to approximate historical structure (loading, vertical, and horizontal structure)
- Can include mechanical pruning or thinning but must include fire (Rx or wildfire)

Brian Firman Rx Fire, Superior, MT
Photo: Matt Panuto

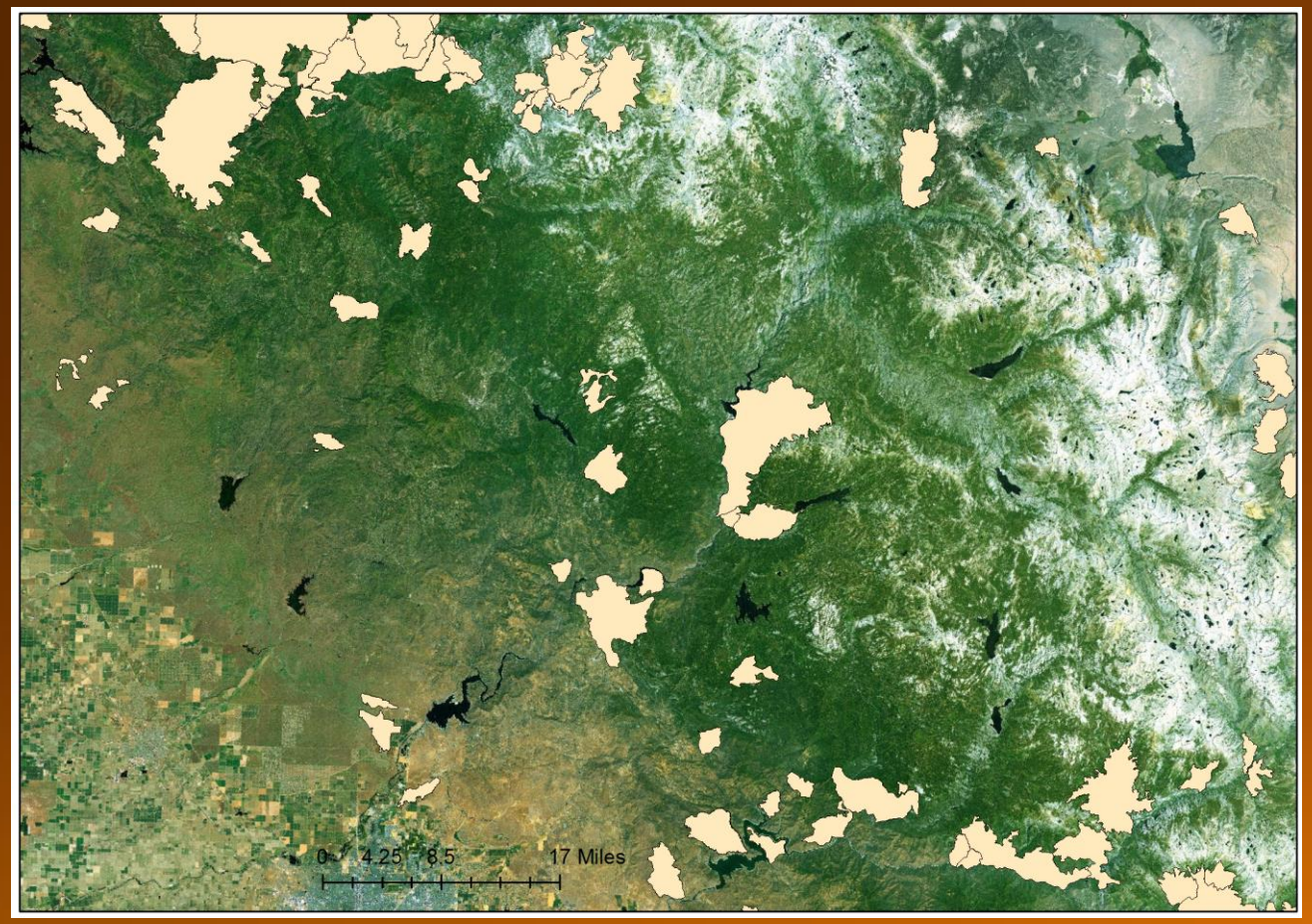
Fire modeling and risk assessment

- Critical gap: ability to understand and project how alternative response policies/strategies would lead to different outcomes on the landscape

- Large fire simulation modeling using FSim
  - Scenario 1: full suppression on all fires
  - Scenario 2: no suppression on lightning-caused fires, full suppression on human-caused fires
  - Scenario 3: mechanical treatment followed by Rx fire everywhere that treatment is feasible



Why do we need to model fire risk? Why can't we just use real fire data?



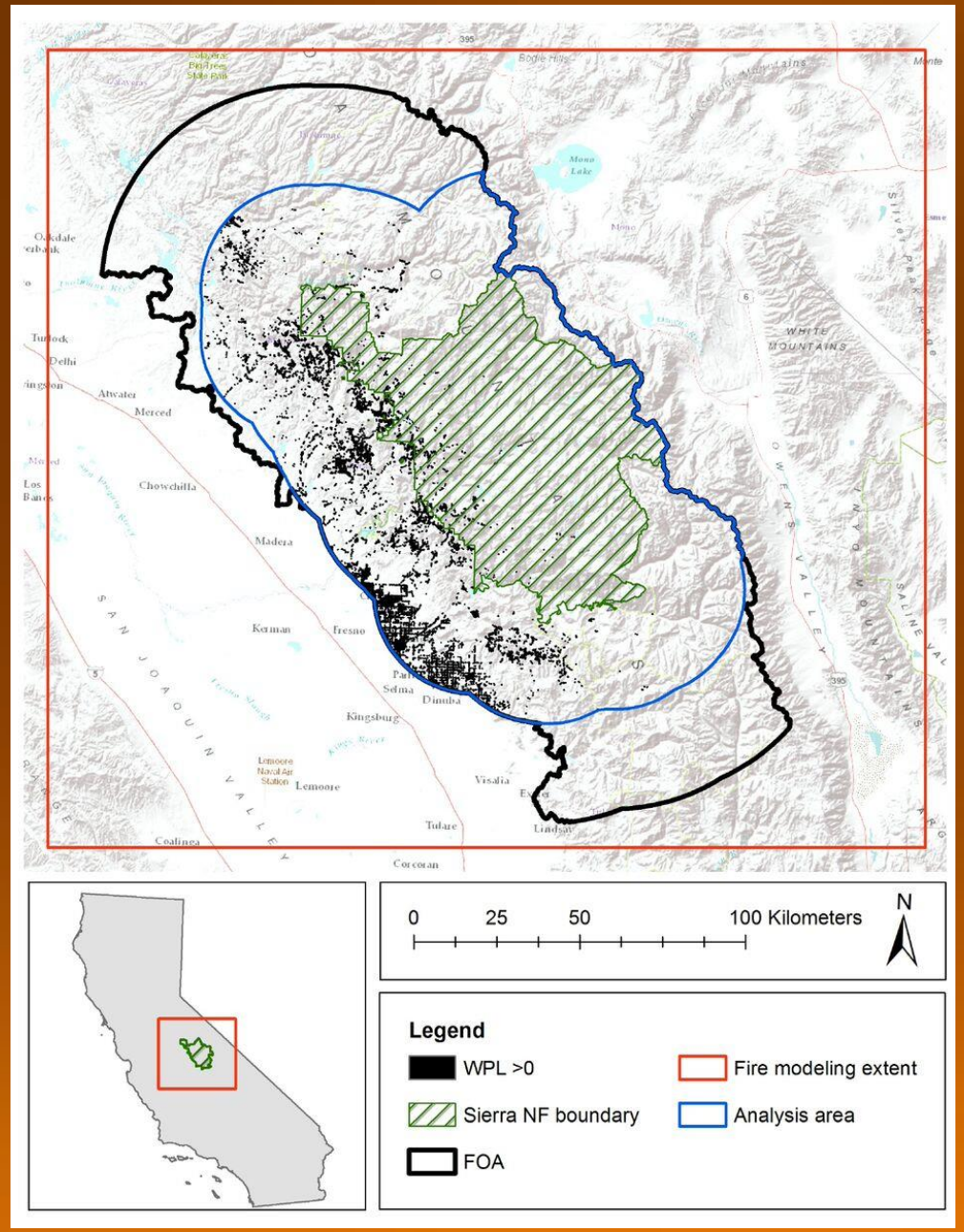
Monitoring Trends in Burn Severity fire perimeters 1984-2014.

Large fires are rare.

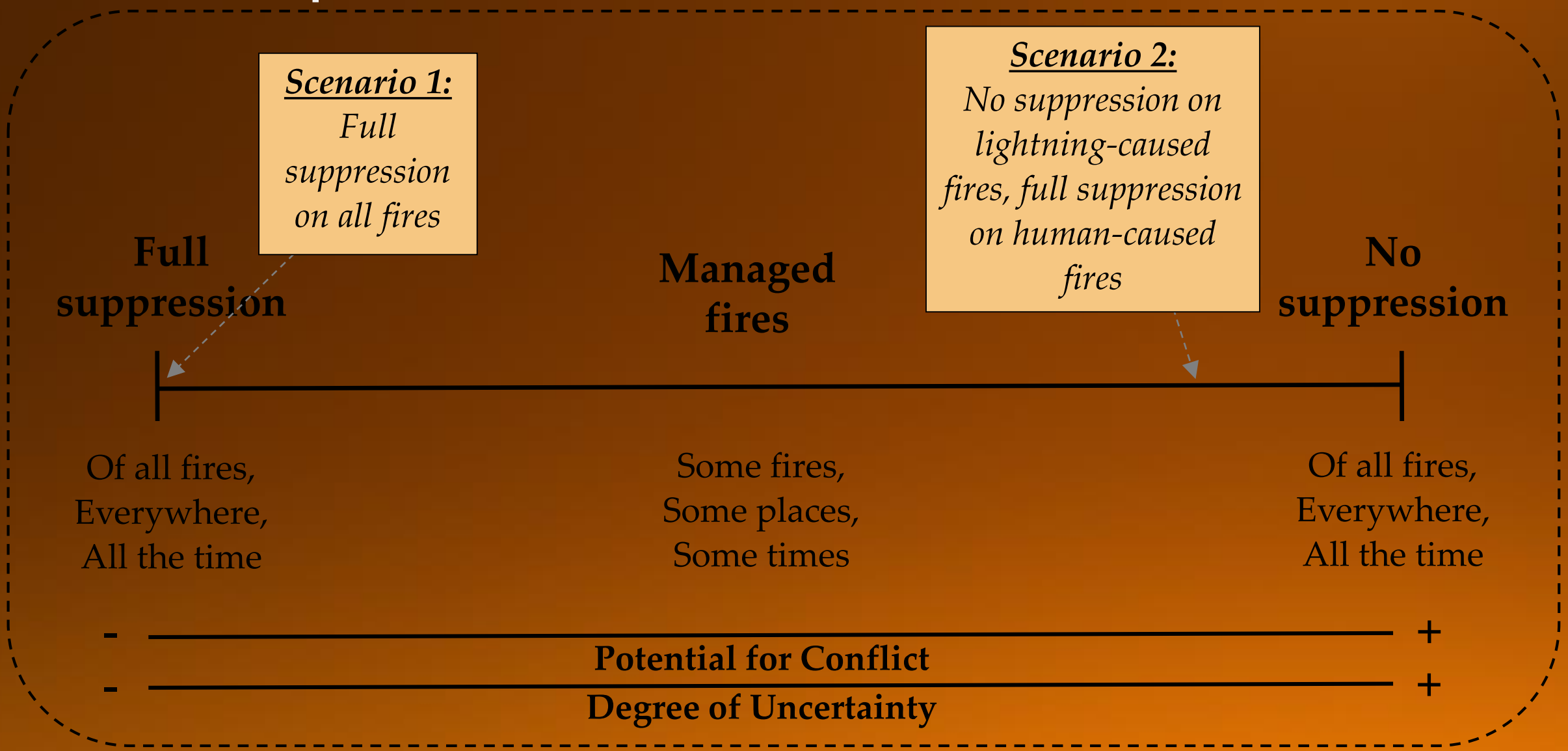
Study area: Sierra National Forest

- Part of broader Southern Sierra Risk Assessment

- Well-studied area
  - fuel treatment opportunities and backlog (North et al)
  - fuel treatment opportunities (Scott et al.)
  - spatial response planning (Thompson et al.)

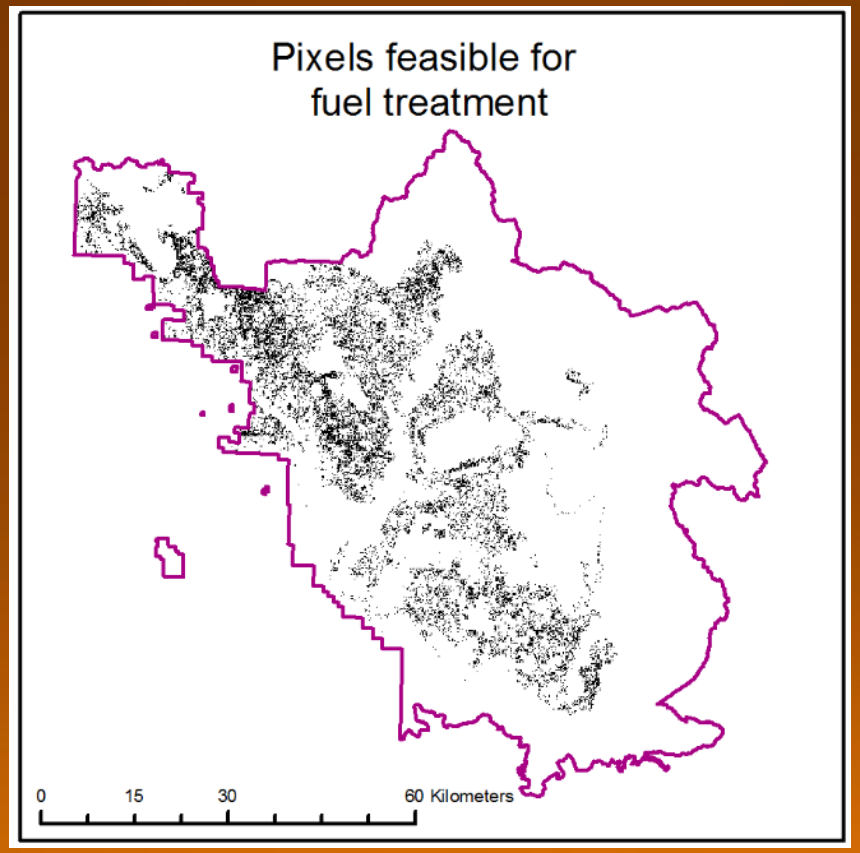


Fire response continuum

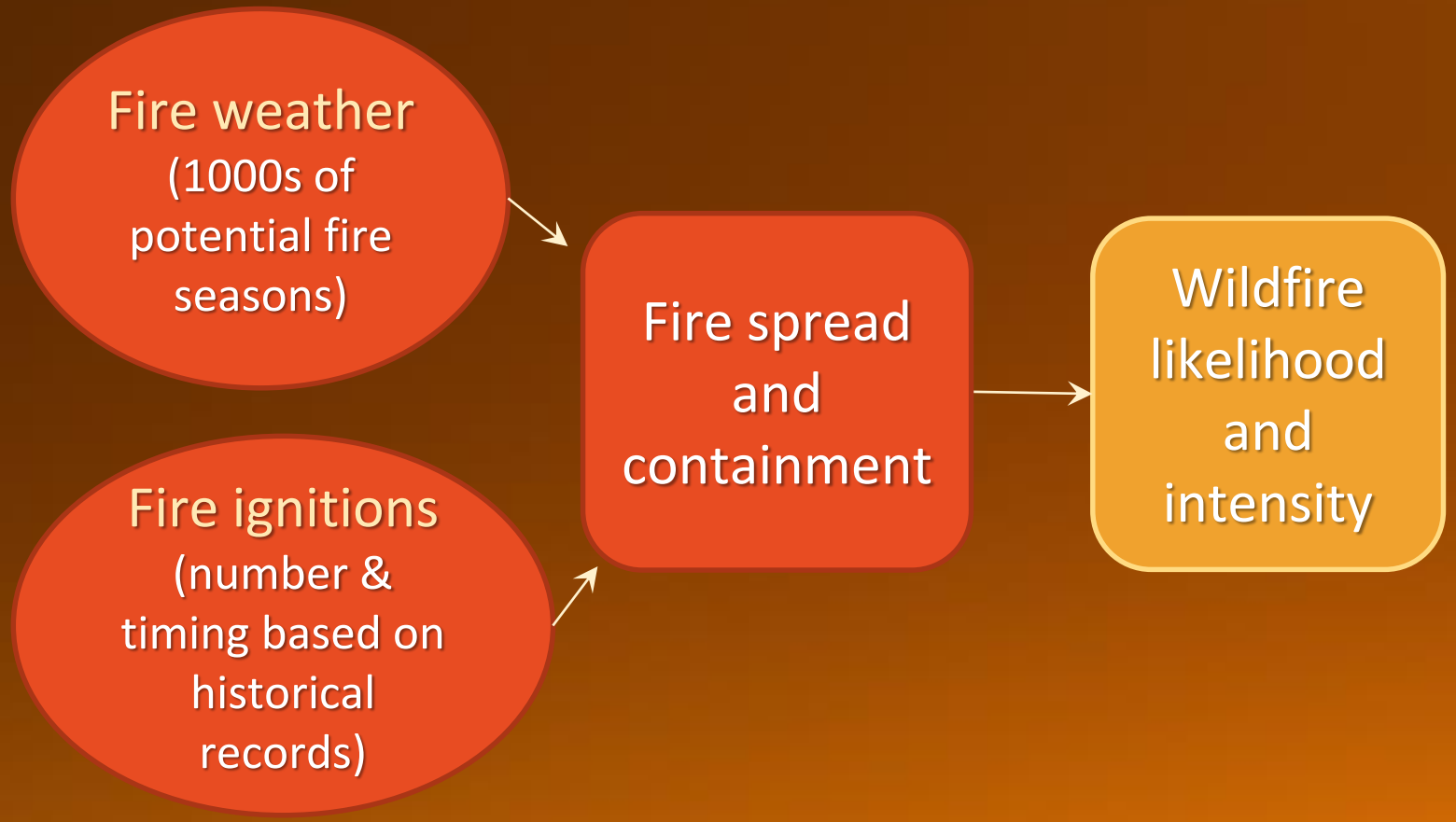


Opportunities for mechanical fuel treatment on the Sierra National Forest, CA

- Scenario 3: Fuel treatment placement was restricted by:
  - Forest land with >35% forest cover
  - Within 2000' of existing road
  - <35% slope within 2000' of existing road and 35-50% slope within 1000' of existing road) (after North et al 2015)
  - Land designation (roadless area and Wilderness not considered)
  - Treatment cost compared to ability to change forest structure
- Result: only 8.6% of pixels feasible for mechanical treatment!



Fire risk modeling using the Large Fire Simulator (FSim)



Finney, Mark A., Charles W. McHugh, Isaac C. Grenfell, Karin L. Riley, and Karen C. Short. 2011. A simulation of probabilistic wildfire risk components for the continental United States. Stochastic Environmental Research and Risk Assessment 25(7), 973-1000.

Fire suppression in FSim

ON

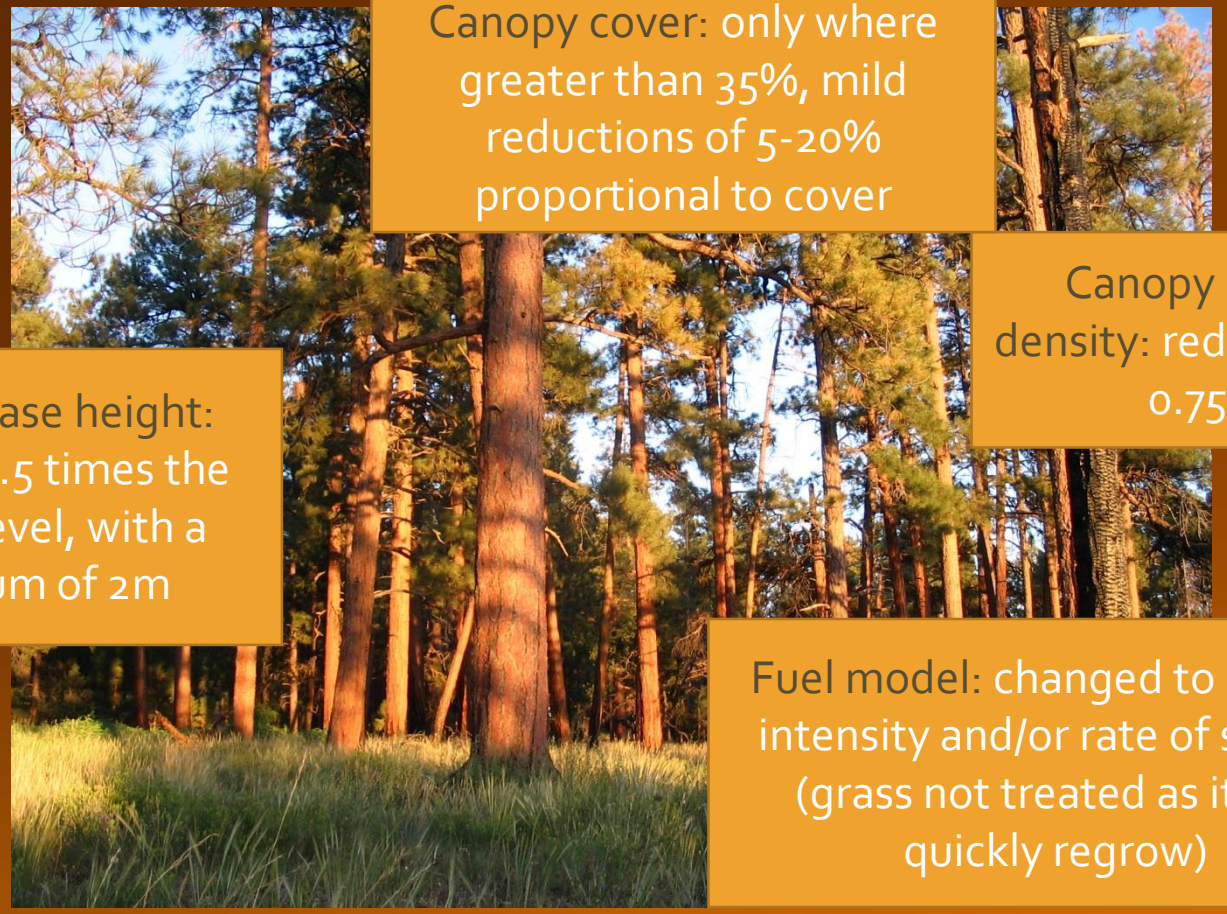
- Each day, probability of containment determined by fuel type, whether fire is spreading quickly, and how long fire has been burning
- Each day, “fireline” built to obstruct fire’s spread

OFF

- Fire put out only by extended period of wet weather

Mechanical fuel treatments

Treatment = meant to simulate a combination of mechanical and Rx fire to reduce flame length and crown fire potential (after Scott et al 2016)



Canopy cover: only where greater than 35%, mild reductions of 5-20% proportional to cover

Canopy bulk density: reduced by 0.75

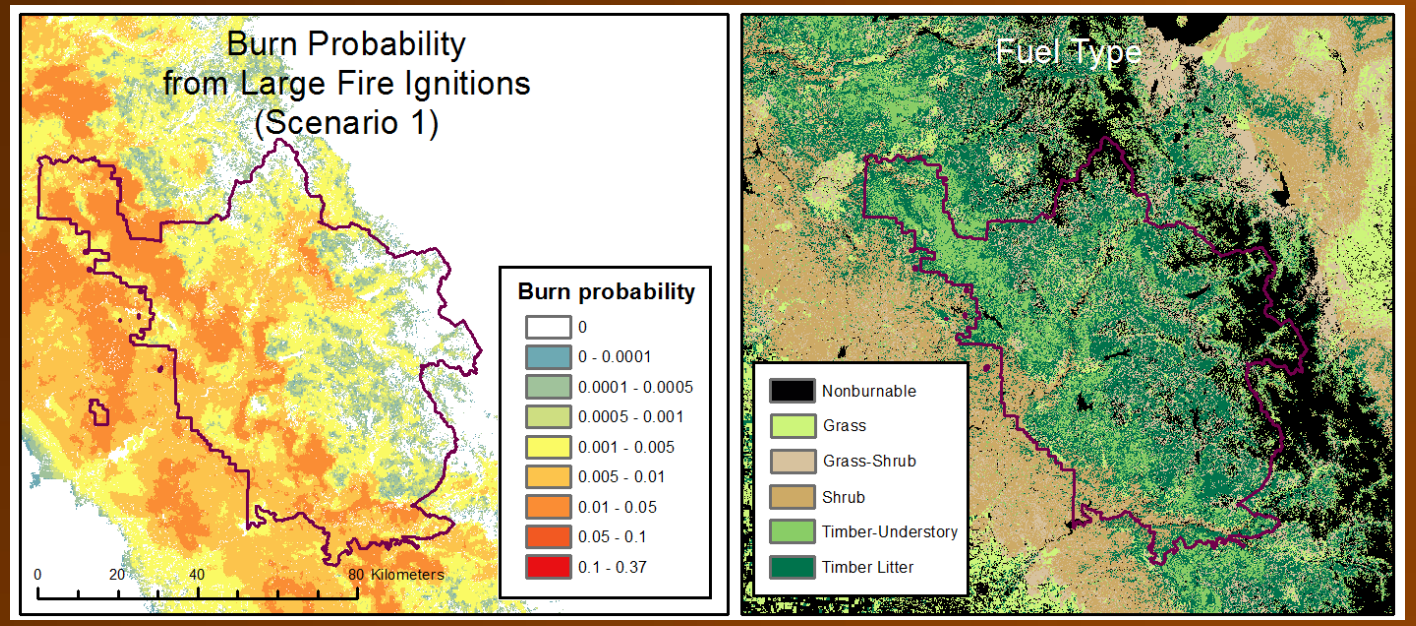
Canopy base height: raised to 1.5 times the current level, with a minimum of 2m

Fuel model: changed to reduce intensity and/or rate of spread (grass not treated as it can quickly regrow)

Scott, Joe H., Matthew P. Thompson, and Julie W. Gilbertson-Day. 2016. *Examining alternative fuel management strategies and the relative contribution of National Forest System land to wildfire risk to adjacent homes – A pilot assessment on the Sierra National Forest, California, USA*. Forest Ecology and Management 362: 29-37.

RESULTS:

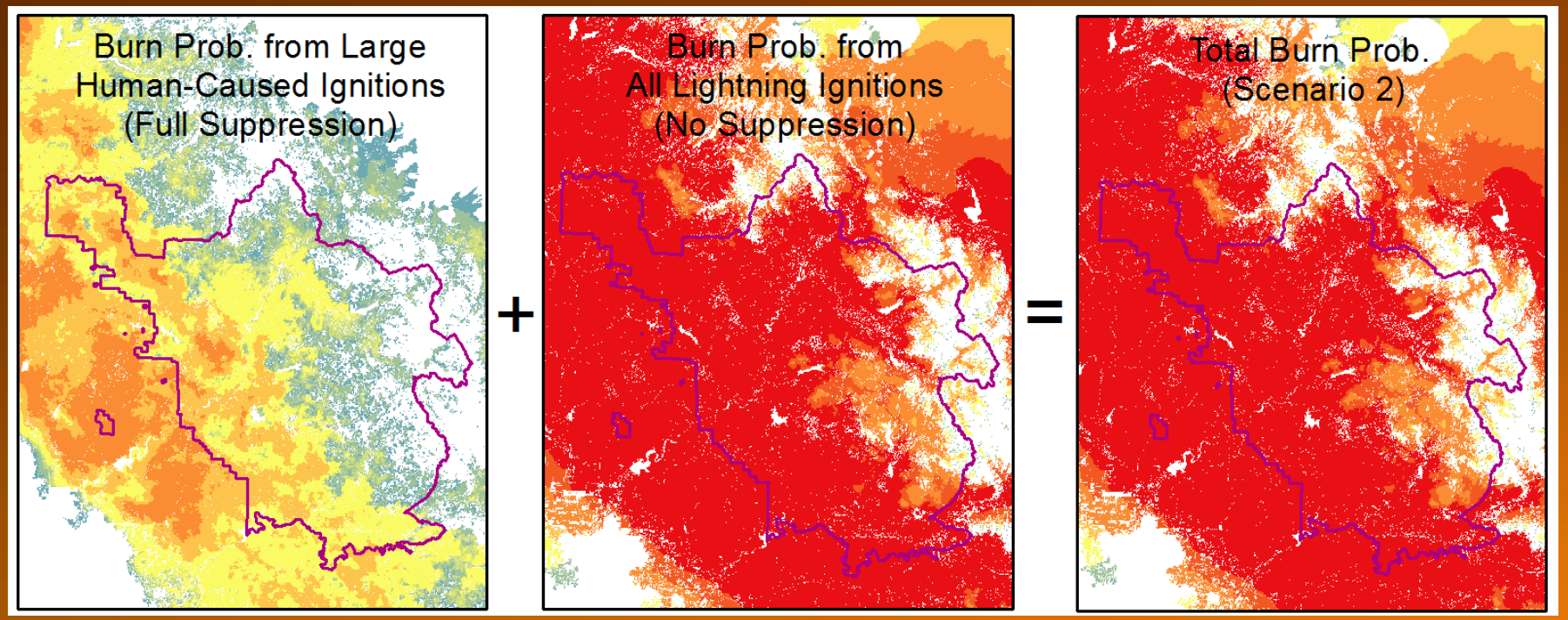
FSim outputs for alternative suppression scenarios



Annual number of large fires = 8.4

Median large-fire size = 976 acres

Annual burn prob.=0.0053

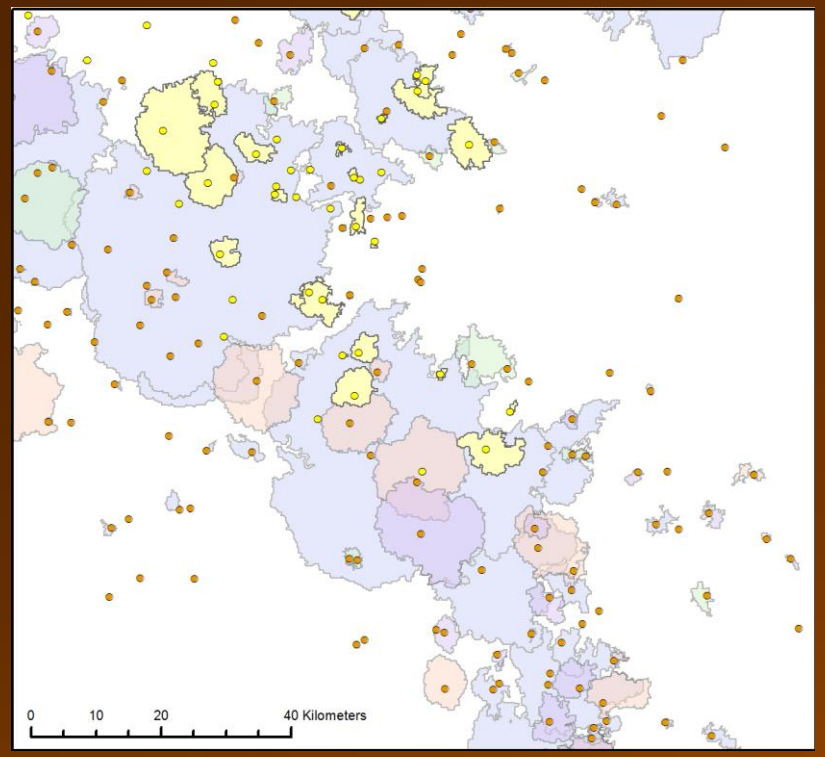


Annual number of large fires = 38.6

Median large-fire size = 4248 acres

Annual burn prob.=0.1751

Feedbacks in burned area



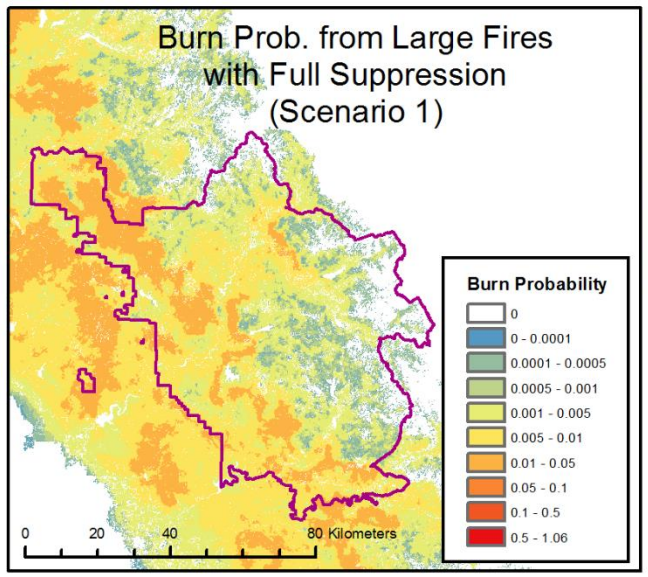
	Mean reduction in area burned due to Type 1 feedbacks in ha (and % of 5-year total)	Mean reduction in area burned due to Type 2 feedbacks in ha (and % of 5-year total)
Scenario 1 (business as usual)	549 (3%)	645 (4%)
Scenario 2 (all lightning + human large)	368,823 (61%)	390,577 (64%)

- Assuming an area can't reburn within 5 years:
  - Some fires wouldn't be able to ignite (ignition locations and perimeters shown in yellow) = Type 1 feedback
  - Areas where perimeters overlap couldn't have burned a second time = Type 2 feedback

- In random samples of 5 years of fires, these feedbacks were substantial
- Take-home point: where we are able to allow fires to burn, they are very likely to act as fuelbreaks for future fires

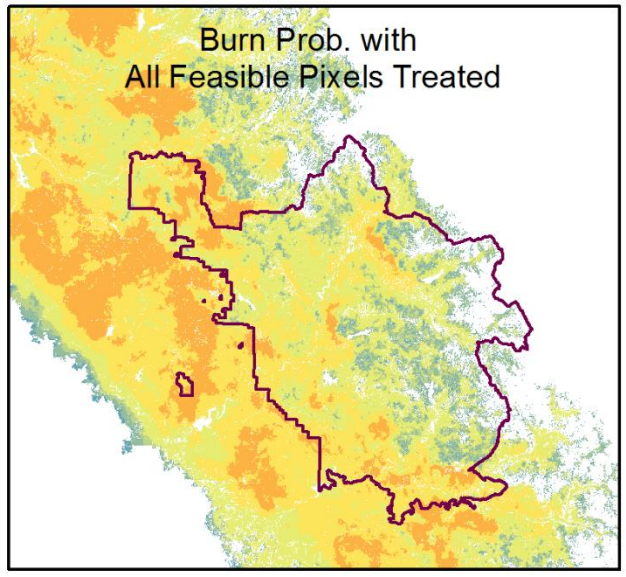
RESULTS: Fsim outputs for Scenario 3, the fuel treatment run

Mean=0.0048

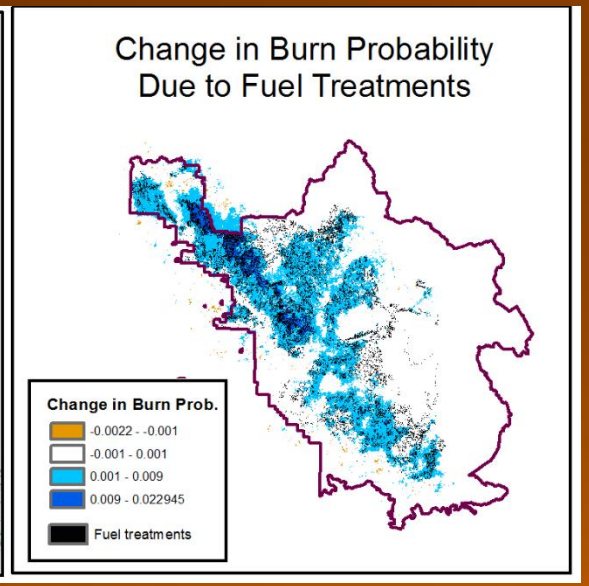


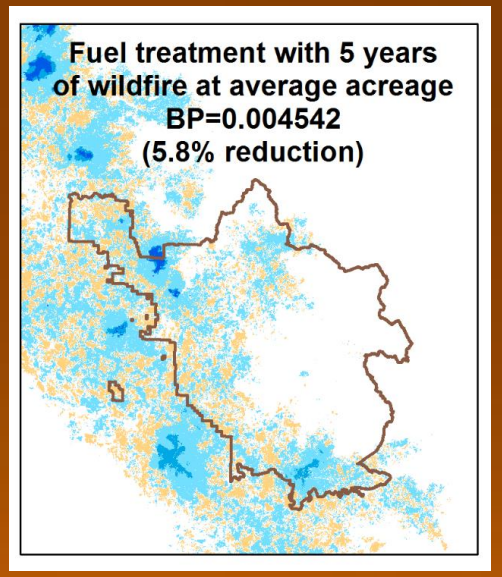
Median fire size=992 acres

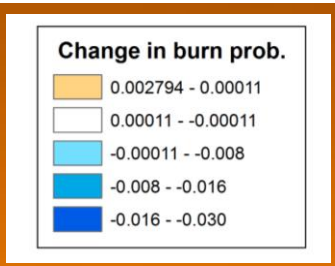
Mean=0.0036



Median fire size=880 acres







Reduction of:

- 25% in burn probability
- 11% in median fire size

Conclusions

- Potential for both mechanical treatment and managed fire to affect landscape
- Mechanical treatment opportunities can be very limited (8.6% of landscape in this case)
- Mechanical treatment can reduce burn probability in the WUI
- Managed fire could be used to treat much broader area of landscape
- However, managed fire does come with increased uncertainty and potential for conflict
  - Can be addressed through pre-fire planning and risk assessment modeling

Questions?

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Prescribed Fire, Banff Park